

Claims

- [c1] A method of forming openings in a substrate comprising:
- providing a substrate having a first surface and a second surface;
 - attaching a removable support film to said first surface of said substrate;
 - forming at least one opening in said substrate by entering said removable support film on said first surface, traversing through said substrate and exiting said substrate at said second surface;
 - wherein said removable support film prevents damage to said substrate by constraining movement of said substrate during formation of said at least one opening.
- [c2] The method of claim 1 further including attaching a frame to said second surface of said substrate, wherein after removal of said support film, said frame constraining movement of said substrate during subsequent processing steps.
- [c3] The method of claim 1 wherein said removable support film comprises a peelable support film, said peelable support film being removed by peeling said peelable support film in a direction substantially parallel to said substrate.
- [c4] The method of claim 1 wherein said substrate is selected from the group consisting of a greensheet, mask layer, metal layer, organic layer, inorganic layer and composites thereof.

- [c5] The method of claim 1 wherein said at least one opening is selected from the group consisting of a via, line, deep hole and channel.
- [c6] A method of processing greensheets for use as microelectronic substrates comprising:
providing a greensheet having a first surface and a second surface; and
attaching a first support film to said first surface of said greensheet,
sequentially processing said first support film and then said greensheet
whereby said first support film constrains movement of said greensheet
to prevent damage thereto said greensheet.
- [c7] The method of claim 6 further including attaching a frame to said second surface of said greensheet, wherein after removal of said first support film, said frame constrains movement of said greensheet during subsequent processing steps.
- [c8] The method of claim 6 wherein said greensheet comprises a material selected from the group consisting of alumina, glass ceramic, aluminum nitride, borosilicate glass, polymeric binders, polymers, metal, plastic, oxides of ceramics, glass frit and glass grit.
- [c9] The method of claim 6 wherein said first support film has a thickness ranging from about 0.5 mils to about 6 mils.
- [c10] The method of claim 6 wherein said first support film comprises a material that has sufficient rigidity to prevent damage to said greensheet during said processing steps.
- [c11] The method of claim 10 wherein said material of said first support film is

selected from the group consisting of a metal, wood product, ceramic, polymer, polyester, polyethylene, polyethylene naphthlate, cellulosid based paper, polypropylene, silicone and composites thereof.

[c12] The method of claim 6 wherein said first support film is cast to said greensheet.

[c13] The method of claim 6 wherein said step of sequentially processed said first support film and said greensheet comprises punching a plurality of openings in said first support film and said greensheet using a punching tool that enters said first support film, traverses therethrough, enters said greensheet at said first surface, traverses through said greensheet and exits said greensheet at said second surface.

[c14] The method of claim 6 further including forming at least one angled opening in said greensheet to provide said first support film attached to said greensheet with at least one weak joint for removing said first support film from said greensheet.

[c15] A method of processing greensheets for use as microelectronic substrates comprising:
providing a greensheet having a first surface and a second surface; and
attaching a peelable support film to said first surface of said greensheet;
forming a plurality of openings in said greensheet by sequentially
entering said peelable support film on said first surface, traversing
through said greensheet and exiting said greensheet at said second
surface,
wherein said peelable support film has substantial rigidity to prevent

damage to said greensheet by constraining movement of said substrate during formation of said plurality of openings.

[c16] The method of claim 15 wherein said plurality of openings are selected from the group consisting of a via, line, deep hole, channel and combinations thereof.

[c17] The method of claim 15 further including attaching a frame to said second surface of said greensheet.

[c18] The method of claim 15 further including attaching a second peelable support film to said first peelable support film.

[c19] The method of claim 18 wherein said second peelable support film comprises a material selected from the group consisting of a metal, wood product, ceramic, polymer, polyester, polyethylene, polyethylene naphthlate, cellulosid based paper, polypropylene, silicone and composites thereof.

[c20] The method of claim 18 wherein said step of attaching said second peelable support film to said first peelable support film comprises:
forming said plurality of openings traversing through said first peelable support film and said greensheet;
depositing an interface layer on said second peelable support film; and
adhering said first and second peelable support films to each other using said interface layer whereby sufficient pressure is applied so as to extrude a portion of said interface layer into said plurality of openings at least in said first peelable support film.

- [c21] The method of claim 20 further including the steps:
screening a metal paste over said second surface of said greensheet so as to fill said plurality of openings and form a plurality of conductive features within said greensheet; and
peeling said stacked layers of said first peelable support film, said interface layer and said second peelable support film off of said greensheet in a direction that is substantially parallel with said first surface of the greensheet without damaging said greensheet and deposited metallurgy.
- [c22] The method of claim 15 further including forming at least one angled opening in said greensheet to provide said first support film attached to said greensheet with at least one weak joint for peeling said first support film off of said greensheet.
- [c23] An intermediate greensheet product comprising:
a greensheet having a substantially planar and undamaged body;
a support film attached to a first surface of said greensheet; and
a plurality of openings traversing through said support film and said greensheet,
wherein said support film constrains movement of said greensheet during formation of said plurality of openings to provide said greensheet with said planar, undamaged body.
- [c24] The intermediate product of claim 23 further including a frame attached to a second surface of said greensheet.

- [c25] The intermediate product of claim 23 wherein said greensheet comprises a material selected from the group consisting of alumina, glass ceramic, aluminum nitride, borosilicate glass, polymeric binders, polymers, metal, plastic, oxides of ceramics, glass frit and glass grit.
- [c26] The intermediate product of claim 23 wherein said support film has a thickness ranging from about 0.5 mils to about 6 mils.
- [c27] The intermediate product of claim 23 wherein said support film comprises a material having sufficient rigidity to prevent damage to said greensheet during said processing steps and a peel strength that enables the removal of said support film without damaging said greensheet.
- [c28] The intermediate product of claim 27 wherein said peel strength correlates to a surface energy of said greensheet with respect to said support film attached thereto.
- [c29] The intermediate product of claim 28 wherein said material of said support film is selected from the group consisting of a metal, wood product, ceramic, polymer, polyester, polyethylene, polyethylene naphthlate, cellulosid based paper, polypropylene, silicone and composites thereof.